

What induces me to this belief is the inconsolable behaviour of the remaining one of a pair should the other be killed, no matter whether the survivor be the male or female. It is really touching. I shall never forget the moaning sobs of the mate of the Lion killed N.W. of Kibwezi during the entire succeeding night, nor the continuous melancholy roaring of the mate of the Lioness killed in Henga in December 1893.

2. On some Nudibranchs from East Africa and Zanzibar.
Part VI. By Sir C. ELIOT, K.C.M.G., late H.M. Commissioner for the East African Protectorate, F.Z.S.

[Received October 6, 1904.]

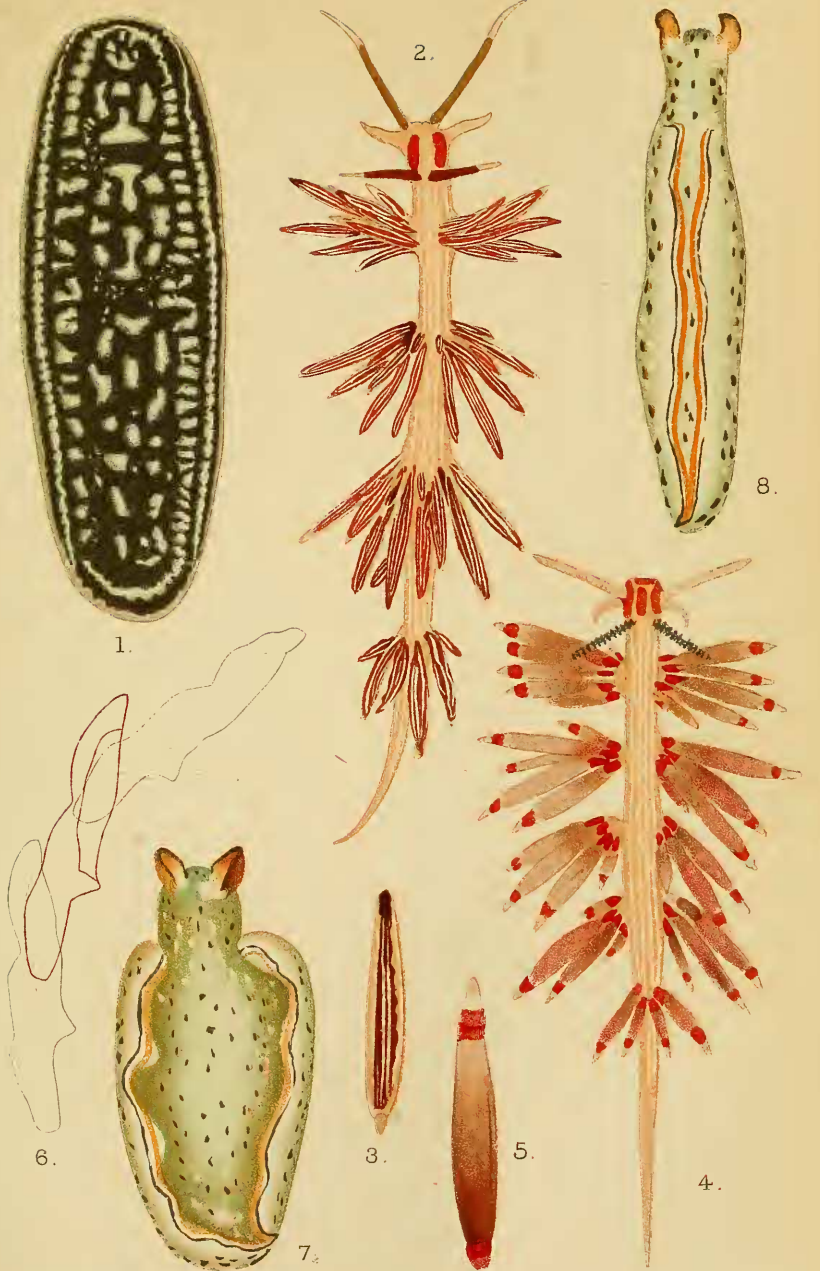
(Plates XVI. & XVII.*)

This paper contains an account of the following Nudibranchs collected in Zanzibar or East Africa:—

1. *Orodoris striata*, sp. n.
2. *Hexabranchius lacer* Cuv., varieties *faustus*, *marginatus*, and *moebii*.
3. *Doridopsis tuberculosa* (Q. & G.).
4. *D. spiculata* Bgh.
5. *D. pudibunda* Bgh.
6. *D. nigra* (Stimpson).
7. *D. denisoni* (Angas).
8. *D. clavulata* A. & H.
9. *D. rubra* (Kelaart).
10. *Phyllidia varicosa* Lamarek.
11. *Ph. nobilis* Bgh.
12. „ „ var. *rotunda*, nov.
13. *Ph. pustulosa* (Cuv.).
14. *Phyllidiopsis cardinalis* Bgh.
15. *Doto africana*, sp. n.
16. *Fiona?* *pinnata* (Eschsch.).
17. *Hervia lineata*, sp. n.
18. *Phidiana tenuis*, sp. n.
19. *Facelina lineata*, sp. n.
20. *Phylloidesmium hyalinum* Ehr.
21. *Stiliger varians*, sp. n.
22. *St. irregularis*, sp. n.
23. *Phyllobranchus prasinus* Bgh.
24. *Cyerce elegans* Bgh.
25. *Placobranchus ocellatus* Van Hass.
26. *Elysia faustula* Bgh.
27. *E. marginata* Pse.
28. *E. dubia*, sp. n.

It is very likely that some of the smaller forms are immature,

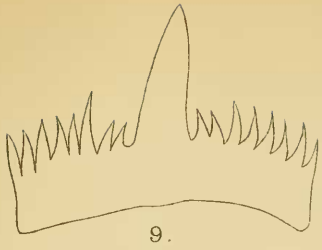
* For explanation of the Plates, see p. 297.



C. Crossland, del

Hutä, sc. et imp.

1. PHYLLIDIA NOBILIS. 2. 3. HERVIA LINEATA.
4. 5. FACELINA LINEATA. 6. STILIGER VARIANS.
7. 8. ELYSIA MARGINATA.



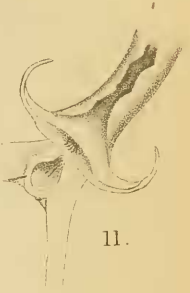
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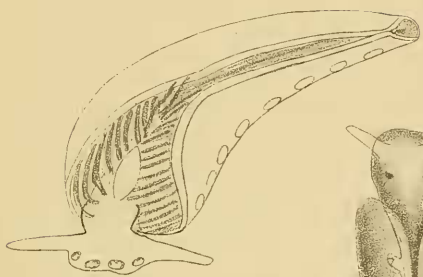
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11.



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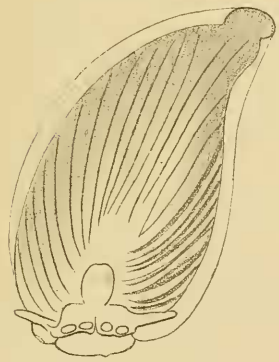
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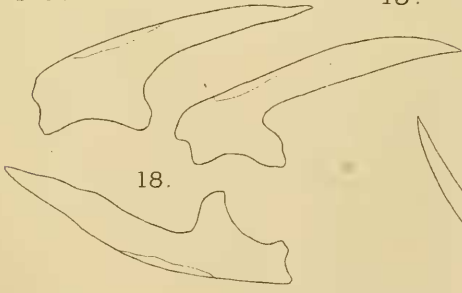
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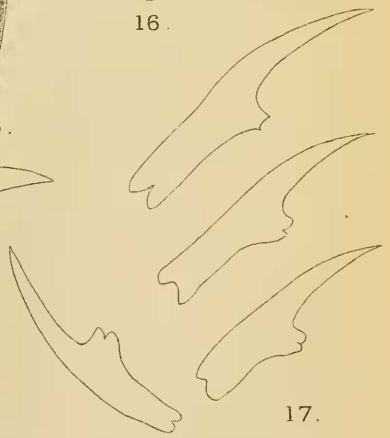
14.



13a.



18.



17.

C. Crossland, del.

Huth, sc et imp

9. MADRELLA FERRUGINOSA. 10. 11. FACELINA LINEATA
12. STILIGER IRREGULARIS. 13. 13a. PLACOBANCHUS
OCELLATUS. 14-17. ELYSIA DUBIA. 18. E. MARGINATA.

but if they are noticed at all it seems simpler to give them a specific name.

MADRELLA FERRUGINOSA.

In the plates of *Madrella ferruginosa* in the first of these papers (P. Z. S. 1902, vol. ii. pl. vi. fig. 6) the central cusp of the median tooth is represented as much too blunt, and I now give a new figure of it (*cf.* Pl. XVII. fig. 9). It is really long and rather pointed. This character is quite clear in the hinder part of the radula, but in the front part it would appear that the end of the central cusp becomes broken or worn off and the point looks blunt as in the first figure above referred to.

ORODORIS.

[Bergh, Jour. d. Mus. Godeffroy, Heft viii. 1875, pp. 67-71.]

ORODORIS STRIATA, sp. n.

One specimen from Pemba found on the shore crawling among *Ulva*. The description of the living animal is as follows:—"Six inches long. The ground-colour of the back is greenish centrally and deep green and chocolate laterally. The mantle-edge has a wide border half an inch wide. The most characteristic external feature is the presence of numerous prominent, narrow ridges running over the back. The back also bears fairly large tubercles over which these ridges continue. There are three circular areas on each side of a deep green colour where the ridges are absent. The ridges are usually white, but in places are tinged with greenish grey. The rhinophores are vertical, the pockets a little raised at the edges. The gills are 8, fairly large, having a fluffy appearance, but not very sensitive. The anal papilla and main rhachis of the gills are pink. The secondary branches are light brown and the smaller branches white. The gill-pocket is irregularly lobed. The mantle-edge is soft but stiff in texture, and may assume a very wavy outline. The under side of the animal is white, with a narrow, irregular, brownish line near the junction of the mantle and the foot."

The preserved specimen has suffered severely from contraction, and most of the internal organs except the buccal mass have been lost through a rent in the side. The actual length and breadth are 71 and 59 mm., but could be increased by at least a centimetre each if the animal were straightened out. The unusually strong and fleshy mantle-edge is 9 mm. thick. The colour is a uniform yellowish white. The characteristic curved ridges are still plainly visible, but the tubercles are somewhat obscured; there seem to be four between the rhinophores and branchiæ and one behind the branchiæ; two can be distinguished on each side. The pockets of the rhinophores are 4 mm. high. The gill-pocket is raised and bears 8 irregular lobes. The 8 branchiæ are strong, with broad stems, and mostly quadripinnate. The anal papilla is large, crenulate, and connected with one of the anterior gills by a

lamina. The foot is strongly grooved in front, but not notched. On each side of the mouth is a large but not very distinctly shaped lump, which seems to represent a retractile and furrowed tentacle.

The labial armature consists of a dense mass of light yellow bent rods, not bifid, exactly like those in Bergh's plates of *O. miamirana*. The radula is large, broad and tough, yellow behind, dark brown in front; it consists of 120 rows, the widest of which have at least 130 teeth on each side of the rhachis. No rhachidian thickenings are visible, but otherwise the radula closely resembles that of *O. miamirana*. The first teeth bear two strong denticles on each side of the central cusp; the next 10-15 are denticulate on the outer side only, bearing as many as 10 denticles. The remainder are simply hamate. The outermost are smaller and rather irregular, but not denticulate.

The specimen is clearly an *Orodoris* and closely allied to *O. miamirana*, particularly the specimen described by Bergh (*l. c.* p. 71) as coming from Zamboanga. It is, however, superficially extremely unlike the preserved specimen of *O. miamirana* given me by Dr. Willey, and I hesitate to regard it as a mere variety. The main difference is that whereas in *O. miamirana* there are ridges on the back formed by compound tubercles, there are in this form a large number of narrow longitudinal as well as transverse ridges which pass over the tubercles as well as the general surface of the back.

HEXABRANCHUS Ehr.

[See (1) Bergh, S. R. Hefte xiii., xvi., and Supplem.-Heft i. (2) Eliot in Gardiner's Fauna and Geog. of Maldive and Laccadive Archipelagoes, vol. ii. part 1 (1903). (3) Bergh in Schauinsland's 'Reise nach dem Pacific: Die Opisthobranchier.']

The Hexabranthidæ, which are very common in the Indo-Pacific, but not recorded from other seas, are large doridiform animals of brilliant coloration and active movements. They differ from the cryptobranthiate Dorids chiefly in having no branchial pocket but a circle of separate branchial tufts, each of which contracts when touched into a temporary hollow which forms at its base. The texture is soft and smooth, the shape flattish, the mantle-margin ample, and the tentacles foliaceous. There is a strong labial armature, and the radula is similar to that of many Dorids, consisting of simply hamate teeth with the formula $\infty.0.\infty$. The verge is extremely long and the nervous system much concentrated.

Bergh observes (*l. c.* (3) p. 225): "Eine Reihe von etwa 20 Arten ist angegeben welche zum allergrössten Theil doch wohl nur Varietäten oder Localformen einer sehr verbreiteten längst erwähnten Art sind, des *Hex. lacer* Cuv.)* My own observations support this, as far as the three forms here mentioned are

* It seems to me quite clear that Cuvier's *Doris lacera* is a *Hexabranthus*, not a *Doridopsis*.

concerned. The shape and colour of the living animals are both very variable. The former can be altered at will from an almost circular to a long slug-like shape, in assuming which latter the mantle-edges are folded over the back. The colour varies even in the same animal, and individuals kept in captivity become conspicuously paler and duller in a few hours. As is usually the case with soft Nudibranchs, the preserved specimens are much subject to distortion in alcohol, and such characters as the expanded or contracted state of the branchiæ and the flat or arched shape of the back appear to have no specific importance. I think that *H. digitatus* described by me (*l. c.*) is a distinct form, but its state of preservation is such that it is difficult to say whether it should be referred to *Hexabranchnus* or to a new allied genus. None of the other specimens which I have examined show any material differences in structure or anatomy. The active habits of the animals perhaps explain how it is that one varying form is spread over so large an area.

The numerous specimens which I have collected in Zanzibar and on the East Coast of Africa represent three varieties:—

(1) *H. faustus* B.—This form, which is not very abundant, seems characterised by its prevailing red coloration and the absence of any white bands. One specimen was of a dark blood-red all over, with only a few yellowish markings at the sides of the visceral mass, but in most cases this dark blood-red is confined to a fairly broad irregular border. The centre of the back is of a lighter red, with mottlings of various tints of red and orange. Between this region and the border the colour is of a dull reddish grey. The specimens obtained of this variety are of moderate size, not exceeding 8 centimetres in length.

(2) *H. marginatus* (Quoy & Gaimard).—This variety, which is also not very common or very large, is characterised by having a broad red band round the mantle, divided in the middle by a white line. In addition to this there is sometimes, but not always, a white edge to the mantle. The middle of the back is mottled red and orange.

(3) The third variety, which is also the commonest, is the animal captured by Moebius at Mauritius, and described by Bergh (*S. R.* xvi. p. 828 ff.) as *H. marginatus* (Q. & G.). Though it is probably not specifically separate from *H. marginatus*, Bergh seems to have overlooked the fact that it constitutes a variety quite as distinct as the other so-called species. Its chief characteristic is clearly given by Moebius:—"Die obere Seite des Mantelgebrämes nach innen porzellan weiss, nach aussen mit breitem rothem Saume von welchem abwechselnd kleinere und grössere Bogen nach innen laufen." Though the difference between this form and *H. faustus* is really only one of degree, the brilliant white band between the equally brilliant deep red border and the variegated central region is most conspicuous, and the animal looks superficially quite distinct from those described above. I propose to call it var. *moebii*.

This variety is very common and grows to a very large size,

one specimen being as much as 25 centimetres long and 16.5 broad. It is very active, swims rapidly, and has been found on the surface of the sea a quarter or half a mile from the shore. The colour of the dorsal surface within the borders is very varying and may be bright light-red, orange, yellow, sandy, almost white, or still more frequently mottled with all these colours. Sometimes the external red border is divided into two parts by a lighter line as in the last variety. The branchiæ exhibit somewhat similar variations of colour, but are generally of a pale reddish yellow with darker lines on the axes and white tips to the pinnae. Sometimes the main axes are bright light green.

I have been unable to find any differences of structure between these three varieties: *faustus*, *marginatus*, and *moebii*. In all the radula consists of from 30–45 rows of simply hamate teeth, rather slender, 65–80 on each side of the naked rhachis. The branchiæ are from six to eight, seven being perhaps the commonest number. Each so-called branchia consists, as a rule, of four plumes (but sometimes of three or five) inserted very close together but not springing from a common stem. Not unfrequently one plume is separated a little from the others, and the individual then appears to have an abnormally large number of branchiæ.

DORIDOPSIS.

This genus is distinguished from the other cryptobranchiate Dorids by having a suctorial buccal apparatus, with no jaws or radula. The mouth is a fine pore situated in the anterior part of the foot; and the internal organs consist of a buccal cone from which issues a long tube which is generally twisted and expands into a dilatation before entering the liver. Beneath the anterior part of the tube is a large folliculate mouth-gland, generally double. The true salivary glands appear to be represented by two nodules at the commencement of the dilatation. The nervous system is very concentrated. The liver is bifid behind. There is an armature of minute hooks on the spermatic duct and glands. On the upper wall of the pericardium are a number of lamellæ, sometimes called the pericardial gill. The animals are generally soft, more rarely spiculous, either smooth or tuberculate. The branchiæ are rather large and few (rarely more than 8), and though they are completely retractile, are very commonly exerted in preserved specimens so as to appear at first sight non-retractile. This feature seems to depend on some peculiarity of texture, and not on any difference of structure.

The genus is very abundant in the Indo-Pacific, and about 60 species have been described, many of doubtful validity. Even in dealing with the forms which are adequately described, it is not easy to draw the line between species and varieties, as nearly all are very variable both in shape and colour, and the internal organs present few features which can be safely used for classi-

fiction. It is noticeable that none of the species here mentioned are new, although in other genera novelties have been abundant on these coasts.

DORIDOPSIS TUBERCULOSA.

[Bergh, Jour. Mus. Godeffroy, Heft xiv. 1878, pp. 38-40, and n S. R. xvi. 2, pp. 845-848.]

Several specimens from the East and West Coasts of Zanzibar.

The following are the notes on one of the living animals:—"Gill-pocket shaped like that of *Asteronotus*, 5-lipped. Gills five, quadripinnate, large, and brown. Rhinophores bent backwards, pockets raised at edges. Body soft but firm; grey with black patches; back covered with large compound tubercles. Under side of mantle and sides of foot a dirty brown with white blotches; foot lighter and without blotches. Free mantle-margin about 20 mm. A most handsome creature."

The dimensions of the largest alcoholic specimens are, length 97.5, breadth 60.5, height 36 mm. The free mantle-edge is ample and the foot of moderate size (58 mm. long by 25 broad). The colour is much as described in the living animals, but in two of the specimens the tubercles are plentifully besprinkled with black dots. The whole back is covered with compound tubercles, which are smaller towards the mantle-edge. The rims of the rhinophore-pockets are prominent but not conspicuous; the club of the rhinophores is set at almost right-angles to the thick stalk and bears 50-60 deep perfoliations. The branchial aperture is raised and stellate; it can be almost closed by five triangular lobes which bear tubercles on the outside. The five branchiæ are quadripinnate with remarkably stout stems. In one specimen there are six lobes and six branchiæ. The anterior part of the foot is much retracted and distorted in all the specimens, but it appears to be thickened and notched but not grooved.

The buccal cone is 5.5 mm. long in the largest specimen. From it issues a long narrow tube (36 mm. by 2 mm.), bent almost into the shape S on the left side, with a smooth interior, which then dilates more or less clearly in different specimens into a sausage-like shape, 25 mm. long by 10 broad. The walls of this dilatation are strong and laminated internally. After it the digestive tract narrows again, and a tube 9 mm. long and 5 broad leads into the hollow of the liver. This organ is very large (51 mm. long by 38 broad), yellow, and distinctly bilobed behind. The mouth-gland is large, yellow, and with several lobes. The salivary glands are small, oval, and set at the top of the sausage-shaped dilatation. The single blood-gland is elongate and purple. The central nervous system is as usual in the genus. The pericardial laminæ are distinct and yellowish. The albumen and mucous glands are very large: the vas deferens is thin, extremely long, and much convoluted. The verge is armed with numerous colourless spines, not much bent, rather irregular in shape and rising out of circular discs.

DORIDOPSIS SPICULATA, B.

[See Bergh, Jour. Mus. Godeff. Heft xiv. p. 37.]

One specimen from Wasin. The notes describe the living animal as three-quarters of an inch long, high and narrow in shape. The back was covered with numerous small, flat-topped warts and was visibly full of spicules, particularly at the bases of these warts. The colour was white, except for a row of small dark grey spots of irregular shape on each side of the visceral mass and a few other scattered spots. The foot was broad.

The preserved specimen is of a uniform greyish white; the skin is hard and full of spicules. The length is 9 mm., the breadth 4, and the height 2.5. The mantle-edge is narrow. The back is covered with flat warts, bearing smaller tubercles, and there are also a few simple papillæ. The branchial opening is not much raised and slightly crenulate. The branchiæ are six, tri-pinnate, and set in an incomplete circle which is open behind. The foot is pointed at both ends, with uncertain traces of a notch and groove in front. The tentacles are small.

The internal organs are mostly yellowish and present nothing remarkable. The pericardial lamellæ and penial hooks are present as usual in the genus.

This specimen has the main characters of Bergh's *D. spiculata* from the Philippines. The difference in form is not remarkable, as the animals of this genus frequently alter their shape from long and high to flat and broad, but the discrepancy in the number and arrangement of the branchiæ throws some doubt on the identification. Bergh's specimen had only four.

DORIDOPSIS PUBIBUNDA, B. ?

[Bergh in S. R. xvi. 2, pp. 844-5. Cf. id. Jour. des Mus. Godeffroy, Heft xiv. 1878, pp. 33-4.]

Four specimens from Chuaka. The ground-colour of the living animals was whitish, but almost hidden by two sets of blotches, one of which varied from light reddish brown to deep dark brown, and the other from pale blue to an inky colour. The intensity of coloration varied in different specimens, and was also greater in the middle of the back than on the mantle-edges. The mantle-edge changed considerably in shape and size with the movements of the animal. The branchiæ were lined with dark brown and not very sensitive; the rhinophores dark brown and tipped with white.

The preserved specimens are stout and high in shape, and have retained their colour fairly well. The largest is 30 mm. long, 17 high, and 22 broad. The mantle-edge is crinkled and allows the sides of the foot to be seen. In one specimen it is much wider than in the others, and this specimen is flatter than the others. The back is smooth, arched, and appears to be swollen. The pockets of the rhinophores and branchiæ are slightly raised and smooth. The rhinophores are somewhat bent backwards and bear about

25 perfoliations. The branchiæ are six in number, quadripinnate, low but strong and bushy. The circuit is open behind, and the subcentral anal papilla very large. The foot is notched in front, but not grooved; the tentacles are small and adherent. The integuments of the body are thick and tough.

From the small reddish buccal cone issues a long thin tube, which is twisted into a shape somewhat like **S** on the right-hand side. The mouth-gland is bilobed. The pericardial lamellæ are yellowish and not very distinct. Bergh says, "Im Penis wurde eine Haken-Bewaffung nicht nachgewiesen"; and I could find none in two specimens. In the third there were clearly visible about 12 rather irregular rows of thick-set, transparent, hooked spines.

These specimens seem referable to the forms described by Bergh in the passages referred to, though the descriptions are not altogether clear. In the specimens from the Philippine Islands the back was "aufgedunsen knotig"; in that from Mauritius, "die Form-Verhältnissen die gewöhnlichen."

DORIDOPSIS NIGRA (Stimpson) A. & H.

[A. & H., Coll. of Nudibr. Molluscs made in India, p. 128; Bergh, S. R. xvi. p. 842, xvii. p. 963; id. Danish Exped. to Siam, p. 191; id. Beitr. zur Kennt. Japan. Nudibr. p. 181.]

Forms which seem referable to this species are among the commonest Nudibranchs on the coasts of both Zanzibar and the mainland. The species, as well known, is extremely variable not only in its colour, but also in its shape, in the number and form of the branchiæ, the presence or absence of tubercles, and the configuration of the anterior foot and tentacles, though with regard to the last point it must be remembered that this is the part of the body which is most liable to be obscured and distorted by alcohol. The internal structure of all the varieties seems much the same, and does not present any very remarkable features. The organs are mostly yellowish. The tube which issues from the buccal cone is at first narrow (generally about 1 mm.) and bent considerably, usually on the left-hand side; it then dilates into a sausage-shaped expansion of about double the width, after which it enters the liver. The mouth-gland is distinct and bilobed. The pericardial lamellæ are well developed. The verge is armed with spines of irregular shape.

The chief varieties are as follows (the texture is in all cases very soft):—

(1) Jet-black, without any spots or markings, but white tips to the rhinophores. This form does not appear to be common; I have only two specimens from Mombasa and two from Zanzibar. The animals are not very large (about 20 mm. long and 10 broad) and flattish. The branchiæ are six. In three specimens the anterior margin of the foot appears to be entire and the tentacles are very indistinct. In the fourth both the tentacles and the groove are clear.

(2) Jet-black, with a brick-red band running round the body,

but wider anteriorly than posteriorly and visible from the under side of the mantle. Rhinophores black with white tips. Foot broad, grey. Branchiæ six. Only one specimen.

(3) Brownish, with a red line much as in the last variety, but occasionally broken and accompanied by red spots at the sides. In the centre of the back are some clusters of whitish spots, and there is a red band round the foot. The genital papilla is yellow and conspicuous. Branchiæ six. The foot is narrow, pointed at both ends, and grooved anteriorly. No tentacles are visible. Only one specimen. Length 24.5 mm., breadth 8.5, height 5.

(4) The commonest variety of all is of a greenish black, of varying intensity, with white spots. A. & H.'s figure No. 13 gives a good idea of an average specimen. The animals are about 30 mm. long and 10 broad, and somewhat globular, though, like most Doridopsids, they can alter their shape. The branchiæ vary from 6 to 12 in number and are usually ample and fluffy. As a rule, the foot is plainly grooved, and the small flattish tentacles are distinct. In coloration there are many subvarieties. Generally there are both clusters of small white spots and scattered larger white spots. In the specimens where the pattern is most developed the clusters are arranged in two symmetrical lines down the back, and the scattered spots are more numerous round the margin, where they tend to form a border. Irregular black blotches may be present or absent. But in some specimens the markings are much reduced, and in one there is only a single white spot.

(5) A variety with raised tubercular spots is fairly common. The specimen which shows this feature best is flat and elongate. Down the centre of the back is an elaborate pattern consisting of clusters of white spots in two rows and scattered white spots between them, and round the mantle-margin is a ring of elongate white spots forming an interrupted border. The spots, especially those near the edge of the mantle, are distinctly raised and tubercular. The branchiæ are fully exposed, 10 in number, and somewhat stiff and meagre. The anterior margin of the foot is grooved and the tentacles are distinct. If this specimen were isolated, I should certainly regard it as specifically distinct, but a number of intermediate forms seem to show that it passes imperceptibly into variety 4, as regards both the tubercular spots and the branchiæ.

(6) I have once found a specimen of a uniform greyish white, with no markings and six branchiæ.

I am indebted to Mr. F. W. Townsend, of the Indo-European Telegraph Service, for two specimens from Karachi, which may be referable to this species. According to his notes and a rough pencil-sketch, the animal was much broader behind than before, of a very deep purple, with a bright crimson line round the undulated mantle-edge. The branchiæ were the same colour as the body and fern-like.

The two preserved specimens retain the coloration fairly well

and are hard and stiff. The largest is 26 mm. long and 12 high, 7 broad as measured across the rhinophores, and 15 across the branchiæ. The integuments are thick and tough, the intestines bright yellow, and as usual in the genus. The branchiæ 8; the anal papilla not in the centre but somewhat to the right.

These specimens do not look like *D. nigra* as preserved, and apparently did not look like it when alive, since they were kept separate from normal examples of the species, but it is difficult to formulate any distinguishing characteristics except the stiffness and thickness of the integuments.

DORIDOPSIS DENISONI (Angas).

D. gemmacea A. & H.

[Angas, Descr. d'espèces nouvelles de Moll. Nudibr., Journal de Conchyl. sér. 3, iv. i. 1864, p. 45; A. & H., Coll. of Nud. Moll. made in India, p. 126; Bergh, S. R. xv. p. 694 ff.]

One small specimen from near Wasin, East Africa.

The living animal was long, narrow, and high; the mantle-edge, though not wide, descended straight down to the ground on each side, so that the sides of the foot were hidden by it. The central part of the back was flat and smooth, but bounded on each side by three large tubercles. Two more stand in the median dorsal line immediately before and behind the rhinophores. A few more tubercles are scattered here and there near the sides. In the centre of the back were two large eye-like spots (similar to those found in some species of *Notarchus*), bright blue with rims of dull dark yellow, and on each side were five double spots (each like the figure 8) of similar colour. The tubercles were tipped with brown, underneath which was a band of yellowish white. The ground-colour of the back and of the bases of the tubercles was reddish brown with clear lines of yellowish white. On the mantle was a border formed by alternate blotches of pale yellow and light crimson. The under surface was of a beautiful pink, deeper towards the mantle-edge, but without markings. The edge of the gill-pocket was slightly toothed. The gills 5, tripinnate, but not ample, white, with dark brown lines on the rhachis. The animal was flexible and lively in its movements; the tops of the tubercles were often drawn in and then thrust out again. The beating of the heart was distinctly visible under the skin.

The preserved specimen is 7 mm. long, 3 broad, and 2.5 high. The mantle-edge is narrow. The lumps on the back remain fairly distinct. The rhinophores are large, the tentacles small. The five gills are erect and strong, but not very ample. The internal organs are yellowish, and seemed to be as usual in the genus. Pericardial lamellæ were not discovered, but this was probably due to the small size of the specimen.

Angas's *D. denisoni* is identified with A. & H.'s *D. gemmacea* by Bergh, in spite of considerable differences of colour, and *D. gemmacea* is said to vary a little in colour and markings. The present specimen is clearly allied to these forms, and as, in view

of its small size, it is probably immature, the difference in pattern is perhaps not specific. The chief distinction is that here we have yellow ocelli with a blue centre, whereas in A. & H.'s specimens there were "lozenge-shaped areas of a rich brown colour, with a few brilliant blue spots in each."

DORIDOPSIS CLAVULATA.

[A. & H., Notice of a Coll. of Nudibr. Molluses made in India, p. 127.]

One specimen dredged between Wasin and the mainland in 10 fathoms.

The following are the notes on the living animal:—"Very like *D. denisoni*. Probably a distinct species, but nearly related. Shape as *D. denisoni*, but even longer. The tubercles are not so large or so definite, and the back is rounded. There are two small tubercles between the gills and rhinophores, and the rest of the back is fairly thickly covered with smooth warts. The mantle has a border formed by blotches of greenish black, white, and yellowish brown. The whitish patches extend inwards, and there are three others in the middle of the back. On each side are three smooth irregular patches of yellowish brown, with scattered slit-like marks of bright blue. Apart from these various markings, the ground-colour is a dull red. The tops of the tubercles are greyish, but this does not altogether hide the underlying red or white. The edges of the rhinophore and gill-pockets are slightly raised, and the latter is wavy. Gills 5, large, feathery, tripinnate, white, with black lines on the rhachis. Rhinophores dark brown, tipped with white, not bent back. Anal papilla large, and keeps up a motion like the beating of a heart. Foot pinkish, with a yellow border, only slightly projecting behind mantle. The animal is infested with numerous white copepoda, especially about the gills."

The alcoholic specimen is very soft and much bent. It would probably be at least 25 mm. long if straightened out; width 13 mm., height 12. The mantle not ample but reaching to the ground. The rhinophore-pockets bear one or two tubercles. The gill-pocket is indistinctly five-lipped and also irregularly denticulate. There are indications of three or four large tubercles on each side of the back twice as large as the rest, although the description of the living animal does not notice them. The foot is deeply notched in front, but not distinctly grooved. The tentacles are thin but distinct. The internal organs are yellow and as usual in the genus. The mouth-gland falls into two halves, each with several lobes.

I think that this may be identified with A. & H.'s *D. clavulata*, which may perhaps be shown by the discovery of intermediate forms to be the same as *D. denisoni*. *D. nicobarica* B. appears to be akin.

DORIDOPSIS RUBRA (Kelaart) A. & H.

[A. & H., Notice of a Coll. of Nudib. Moll. made in India, p. 126; Bergh, Danish Exped. to Siam, Opisthobranchs, pp. 190-1.]

This form is common both in Zanzibar and on the mainland. The notes on the living animal describe it as a "Large bright red *Doridopsis*, between crimson-lake and vermilion: the back above the viscera blotched with small irregular spots of chocolate-brown. Length two and a half inches, breadth at most two inches; texture of skin smooth and shiny; body very contractile. Gills 6, feathery, tripinnate. Gills and rhinophores rapidly and completely retractile."

Six specimens are preserved, all much contracted and blistered. Two are uniformly white; in the rest the dark mottlings remain. The skin is soft and smooth; the mantle-edge fairly ample; the foot fairly wide and slightly pointed both before and behind. The rhinophores are set very far in front and the branchiæ very far behind. The pockets of both have slightly raised smooth margins. The branchiæ are tripinnate, generally exposed, fairly luxuriant, and apparently six in all specimens. No head or tentacles are visible in any of the specimens, but while in the two white ones the anterior margin of the foot appears to be simple, it is distinctly grooved in the others.

The internal organs are mostly of a reddish yellow and arranged as usual in the genus. The mouth-gland is bilobed. From the buccal cone issues a long thin tube about 1 mm. broad, which is generally curved into the shape of **S**, and then dilates into a wider portion, about 2 mm. broad, which is constricted before it enters the liver. The mouth-gland is bilobed, the eyes large and distinct. The verge and part of the seminal duct are armed with small hooks of a rather irregular shape.

The difference of colour in the preserved specimens, coinciding as it does with a somewhat different shape of the anterior pedal margin, suggests that the specimens may really belong to two species, although the notes do not indicate any difference in the appearance of the living animals. Possibly *D. rubra* and *D. brockii*, as Bergh suggests, are merely varieties of a very variable form.

PHYLLIDIADÆ.

[See Bergh, "Bidr. til en Monogr. af Phyllidierne," Naturh. Tidssk. 3 R. v. 1869; id. Neue Beitr. zur Kenntniss d. Phyllidiaden, 1876; id. in S. R. xvi., xvii. Eliot, Nudibranchiata in Gardiner's Fauna of Maldives and Laccadives, p. 560 ff.]

The structure of these well-known and unmistakable animals has been so thoroughly examined by Bergh that it need not be described here. Five genera have been proposed: *Phyllidia* (Cuv.) B., *Phyllidiella* B., *Fryeria* Gray, *Phyllidiopsis* B., and *Ceratophyllidia* Eliot. The last three genera have all decided characters. In *Fryeria* the vent is terminal and not dorsal; in

Phyllidiopsis and *Ceratophyllidia* the mouth-parts are much as in *Doridopsis*, the glands not being fused with the buccal tube, and *Ceratophyllidia* has the additional peculiarity of bearing stalked globes on the back. The distinction between *Phyllidia* and *Phyllidiella* seems to me less certain. According to Bergh, (a) the oral tube is symmetrical in *Phyllidia*, asymmetrical in *Phyllidiella*; but I have not found the difference to be clear or persistent, and even if it is so, I doubt if it is of generic worth. (b) In *Phyllidia*, "Dorsum tuberculis elongatis, plus minusve confluentibus obsitum, medio varicositates longitudinales formantibus." In *Phyllidiella*, "Dorsum proprium tuberculis discretis vel pro parte confluentibus quincunces formantibus obsitum." Even in typical forms it does not appear that this distinction is clear. *Phyllidia elegans* (see Bergh's Monograph, pl. xix. fig. 1) seems to me to have not "varicositates longitudinales," but groups of confluent tubercles; and, on the other hand, *Phyllidiella pustulosa* strikes me as having not so much tubercles arranged in "quincunces," as compound tubercles arranged in lines. But in abnormal forms, which are frequent, it is still harder to draw the distinction. I have a fine specimen with all the characters of *Phyllidia varicosa*, but the median ridges, though very distinct posteriorly, are broken up in front and unite to form a quincunx as in *Phyllidiella nobilis*. Again, in this latter, the quincunces are often placed so regularly above one another that the tubercles seem to be arranged in longitudinal lines and not in figures. I therefore think it better to abandon *Phyllidiella* as a separate genus.

The arrangement of the dorsal tubercles in these forms is so variable, that it is hard to draw the line between species and varieties, but at least three certainly specific forms occur in East Africa:—

(1) *Ph. varicosa*.—Colour black, blue, and orange; rhinophores yellow. A black stripe on the foot. Tubercles more or less fused into ridges, but not compound. Typically, there are three long ridges down the centre of the back and a number of short ridges, more or less at right angles to them, running inwards from the mantle-edge. Buccal mass yellow and very complicated.

(2) *Ph. pustulosa*.—Black and green; rhinophores black, no black line on foot. Tubercles simple or composed of only two or three lumps. Buccal bulb partly black.

(3) *Ph. nobilis*.—Colour as in *Ph. pustulosa*, but tubercles highly compound, sometimes consisting of ten small lumps fused together. Typically, they are arranged in square or oblong figure. Buccal bulb large, yellow.

That the patterns formed by the tubercles should vary is not surprising, if we consider that the tubercles have always a tendency to unite, and may do so more or less decidedly in a given direction. Thus the typical form of *Ph. varicosa* occurs when the lateral tubercles unite in a predominantly transverse direction. When however, union in a longitudinal direction

predominates, a variety is formed which seems to have five or seven longitudinal rows.

As I have mentioned elsewhere, my observations do not confirm the statements of the older naturalists as to the torpidity and immobility of the Phyllidiadæ, which seem in this respect much like the average Dorid. *Ph. varicosa* is the most active and crawls quite rapidly; *Ph. nobilis* when in captivity crawled continually but slowly; *Phyllidiopsis cardinalis* was sluggish but not motionless.

The Phyllidiadæ are common in the Indo-Pacific, but appear not to be littoral. They are generally found in a few fathoms or in spring-tides at extreme low water.

PHYLLIDIA VARICOSA Lam.

[Bergh, Bidr. til en Monogr. p. 500 f.]

This large, handsome animal is common on the coasts of Zanzibar and the mainland of East Africa. My largest specimen is 73 mm. long and 32 broad, and specimens measuring 50 or 60 mm. are not infrequent. The colour in life is glossy black, with slate-blue ridges on which are bright orange-coloured projections. The rhinophores are bright light yellow. The tubercles are more or less confluent. Down the middle of the back run three ridges bearing 12-16 tubercles. From the sides of the mantle there run inwards about 30 ridges, less uniformly continuous than those in the centre and bearing each two or three tubercles. The openings for the rhinophores and anal papilla are small and placed in tubercles, not on the smooth surface of the back. The tentacles are digitiform and yellowish. The buccal mass is large, yellow, and, as Bergh says, "magnopere compositus." The foot is broad, and bears in the middle a distinct black line 1.5 mm. wide in large specimens. There are sometimes black mottlings at the side of the line. Variations from the typical form are frequent. In one specimen the three longitudinal ridges are all fused together to form a central dorsal prominence, whose tripartite nature is only obscurely visible. In another the three unite in the posterior third of the body, though before it they are separate. In one very fine specimen the three ridges are very distinct behind, but in the anterior third of the body form a group of tubercles like those found in *Ph. nobilis*.

The most distinct variety, however, is one which perhaps corresponds to Bergh's *Ph. fasciolata**, which also comes from East Africa (Comoro Islands), and which he appears to regard as not specifically distinct. It is characterised by having from five to seven ridges on the back, in which the tubercles are more distinct and the connecting-lines less developed than in the typical form. The lateral ridges are almost entirely absent. The rhinophores vary from yellow to grey. The bulbus pharyngeus

* Bidr. til en Mon. af. Phyllidierne, p. 507. "Ph. varicosæ et eleganti forma et caractere dorsi affinis, sed rhinophoriis nigerrimis, varicositatibus dorsalibus (7) sat tuberculosus."

is as in the typical *Ph. varicosa*. This variety when preserved sometimes superficially resembles *Ph. pustulosa*, but I think it should be referred to *Ph. varicosa* because (1) there are intermediate forms; (2) the bulbus pharyngeus is not black; (3) the foot is marked with a broad black line.

PHYLLIDIA (PHYLLIDIELLA) NOBILIS B. (Plate XVI. fig. 1.)

[Bergh, Bidr. til en Monogr. p. 512 ff.; & id. S. R. xvi. 2, p. 860 ff.]

This species is common, but does not attain a large size, the finest specimen being 36.5 mm. long by 18 broad. The back is black, with sea-green tubercles. The under surface and branchiæ are greenish grey, and there is a yellowish border round the foot. The rhinophores are black. The patterns on the back vary considerably, but the ground-plan appears to be in all cases two or three borders running round the mantle and a series of oblong figures in the centre. The tubercles are mostly compound, and sometimes consist of as many as ten small lumps fused together. In one of the most regular specimens there is first a green border showing hardly any traces of tubercles (this feature appears invariable), then a circular band of narrow tubercles, then a similar band of much broader and more composite tubercles. Down the centre of the back are arranged four oblong figures; the sides of each are composed of two tubercles and the top and bottom of one; within the area are two tubercles. All these prominences are compound, but a number of little simple tubercles are scattered here and there. This arrangement varies considerably owing to the borders and figures running into one another. In other cases the central figures are placed accurately one above the other, and the tubercles then appear to be arranged in straight lines. Bergh's uncoloured plates (S. R., Heft xvi. 2, pl. lxxxiv. figs. 11 & 18) give a good idea of the animal, but in my specimens the borders are more distinct and circular. The drawing in Plate XVI. fig. 1, by Mr. Crossland, is a fair representation of the average East-African specimens, though a little less regular than the one described above. It fails, however, to indicate that all the larger tubercles are compound. In many specimens the green parts have a tendency to coalesce and form blotches, but I have never seen this so highly developed as in the animal figured in Bergh's 'Opisthobranchs of the Danish Expedition to Siam' (plate ii. fig. 15).

The openings for the rhinophores and anal papilla are very small and situated in or at the edge of tubercles. The buccal mass is very large and, like the rest of the intestines, yellow, but in some specimens has a little black pigment in front.

PHYLLIDIA NOBILIS, var. ROTUNDA.

Two specimens constitute a very distinct variety, possibly meriting specific rank. From the absence of notes it may,

perhaps, be concluded that the living animals were black and green like ordinary individuals. As preserved, the back is black, with brilliant white tubercles; the under side greyish yellow, the rhinophores black, and the branchiæ greenish; several black bands run from the mantle-edge to the branchiæ on the under side. The tubercles are compound as in the ordinary form but more projecting, and show a few black depressions between the confluent lumps. There are no borders or rings of tubercles round the mantle, but both in the centre and round the margin the tubercles are arranged in square or oblong figures. The buccal mass is large and deep orange. The shape of the whole animal is much broader than usual, being about 23 mm. long by 18 wide, but the end of the foot and mantle are pointed.

If this animal proves to be sharply distinguished from *Ph. nobilis*, it is no doubt a good species, but it will probably be found to be connected with the ordinary form by a series of links. It bears a certain resemblance to Van Hasselt's figure of his *Ph. verrucosa* (v. Bergh, "Die Van Hasselt'schen Nudibranchien," Notes from the Leyden Museum, vol. ix. 1887, p. 313, and plate 6. fig. 7), but does not coincide in details.

Much the same may be said of another specimen in which the tubercles were pink rather than green in life. The three borders and central pattern are very regularly developed as in the typical form described above, but the raised parts are fused into flat, smooth ridges, with hardly any indication of knobs.

PHYLLIDIA (PHYLLIDIELLA) PUSTULOSA (Cuv.).

[Bergh, Bidr. til en Monogr. p. 510 ff.]

I have only two specimens of this form, which would hence appear not to be very common on the East Coast of Africa. It is more elongated than *Ph. varicosa* and *nobilis*, the larger specimen measuring 33 mm. in length and 11 in breadth. The colour of the back is a very deep bright black with green tubercles. The rhinophores and branchial lamellæ are also deep black, but the sides of the body, the foot, and the oral tentacles are slate-coloured. Many of the tubercles, especially in the centre of the back, are compound, and are composed of two or three, rarely four, partly fused together. In the more regular of the two specimens there are three borders of tubercles round the mantle-edge, and three groups, composed of four compound tubercles each, down the centre of the back. These three groups are separated from one another by straight transverse rows composed of three tubercles each. In the other specimens, though the number and character of the tubercles are nearly the same, the pattern is less regular, and the general impression given is of five moderately straight lines down the back. The openings for the rhinophores and anal papilla are rather large, and are placed not in tubercles but on the flat surface of the back. The buccal mass is large; parts of it are yellow, but below and in front it is black.

PHYLLIDIOPSIS CARDINALIS B.

[Bergh, Neue Beiträge zur Kenntniss der Phyllidiaden, Verhandl. der k.-k. zool.-bot. Gesell. in Wien, 1876.]

Four specimens, one from Zanzibar and three from Wasin, were obtained of this form, which has hitherto been recorded from Tonga. One specimen (from Zanzibar) is of considerable size, being 37 mm. long, 15·5 broad, and 13 high. The others are much smaller, being about 15 mm. long and 7 broad. The notes on the living animal say that the larger specimen had the under side, branchiæ, and sides of foot light yellow. On the back were dark reddish-brown blotches bearing black warts alternating with sandy blotches bearing sandy warts, irregularly arranged. Rhinophores dull green, anal papilla bright yellow. The smaller specimens had a lighter coloration. The following are the notes on one of them :—"Ground-colour light yellow. On the under side this is only interrupted by dark green dots along the edge of the foot, and blotches, which are black at their extreme edge, on the mantle. They appear dorsally as black blotches. On the sides of the visceral mass are large black blotches, greenish at the edges, three on one side and two on the other. In the centre of the back are three large reddish-brown blotches. The tubercles are the colour of the blotches on which they occur. Between the red and black blotches is a coarse, clear network of greenish brown. The rhinophores are dark bright green and the anal papilla bright yellow." In the alcoholic specimens all trace of yellow has disappeared, and the general coloration is a dull purplish red with indications of black spots. It would appear that the alcohol liberates the red pigment, which then overpowers the other colour, a phenomenon which I have observed in some preserved Chromodorids.

The general aspect of the preserved specimens resembles *Doridopsis*, the back being covered with pyramidal compound tubercles not unlike those of *D. tuberculosa*, but quite different from those of *Ph. nobilis*. In the largest specimen there are three distinct lines of 8-10 tubercles in the central area, two other lines less distinct, one on each side, and a number of irregular tubercles round the mantle-edge, arranged in two or three lines and decreasing in size outwards. There are also scattered simple tubercles all over the back. The openings of the rhinophores are small and inconspicuous, that of the anal papilla large and circular. The branchiæ are dull red; they run up nearly to the mouth, and are otherwise only interrupted for about 2 millimetres on the right-hand side by the genital papilla. The smaller, and doubtless younger, specimens are very like the large ones, but the tubercles are less developed.

The buccal parts are much as in *Doridopsis*. From the mouth issues a thickish tube with laminated walls inside. It is bent towards the left and back again, and the central nervous system lies at its posterior end. It is 2·5 mm. broad and about 4·5 long, but would be considerably longer if straightened out. From

this issues a much thinner tube, about 5 mm. long and 1.5 broad, with muscular walls. After a sharp constriction it continues again for about 5 mm., and enters the liver rather far back. In the large specimen the posterior part of the tube is much the same size as the anterior. In the smaller ones it is considerably more inflated. A purplish gland lies under the first-mentioned thick portion of the above tract, but is not fused with it as in the other Phyllidiadæ.

DOTONIDÆ.

DOTO AFRICANA, sp. n.

One small specimen found on a Sertularian at Chuaka. The notes on the living animal are as follows:—"Ground-colour of body grey-black with two white stripes; sides of foot also white. Rhinophore-sheaths large, also grey-black. Six pairs of cerata, of which the third is the largest and the fifth and the sixth very small. Cerata yellow-brown, with dark blue tips to the tubercles."

The preserved specimen is 3 mm. long, and has retained its coloration fairly well, though the difference between grey-black and dark blue is not visible. The cerata are relatively large, the tallest being nearly 2 mm. high. They are of the shape usual in the genus. The third pair bears sixteen rounded tubercles, that is four rows of four each; the others have fewer tubercles according to their size, and the sixth pair are simple warts. The rhinophore-sheaths are large and stout, not much broader at the top than at the bottom, the edges of the cavity smooth and not turned outwards. The rhinophores are completely contracted within the sheaths. In front of each sheath lies a tubercle or short ridge, pointing towards the edge of the oral veil, which is large and circular. The anal papilla is yellow, and lies between the first and second cerata on the right side.

The delicate and transparent jaws, though hardly visible, appear to be of the generic type, with smooth edges. The radula consists of a single row of about 70 teeth, of horseshoe-shape, but somewhat more rectangular than usual. The central cusp is well developed, and there were faint indications of two or three denticles on each side of it.

This does not appear to be Bergh's *Doto indica* or his *Doto* sp. (Mal. Unt. 1894, vi. 1, p. 13), and it seems necessary to create a new species, though in the case of so small an animal there must always be some doubt whether it has assumed its mature and specific form. The most distinct character is the presence of two tubercles in front of the rhinophores. Cf. the ridges in *D. fragilis* and *pinnatifida*.

ÆOLIDIADÆ.

FIONA? PINNATA (Eschscholtz).

[Eschscholtz, Zool. Atlas, 1829, p. 14; Bergh, Journ. Mus. Godeffr. Heft ii. 1873, pp. 87-88; id. Beitr. z. Kennt. der Æolidiaden, i. p. 605.]

One specimen was found on a dead nautilus-shell which was

floating between Zanzibar and Prison Island. On the shell were also *Clytia* and a small species of barnacle. The notes on the living animal are as follows:—"Foot colourless and transparent. Upper surface of body has a yellowish-brown tinge, which is deeper on the tips of the cerata. The liver-canals appear as dark greenish brown. The foot projects behind the cerata for some distance. Cerata numerous; they bear on the inside a wrinkled branchial membrane."

The preserved specimen is much bent, and would perhaps measure 20 mm. if straightened out. It is about 5 mm. broad. The general shape is much that of *Fiona nobilis* (= *marina*), as figured by Alder and Hancock, and the foot does not project much behind, as it did in the living animal. The bare space in the centre of the back is not large. On each side is a thick-set longitudinal row of about 60 or 70 cerata. The transverse arrangement is irregular, but in a given line there are generally two or three large cerata, and one or two quite small ones outside. The cerata are somewhat thicker and more inflated than those in specimens of *Fiona nobilis* received by me from Naples. The larger ones bear on the inside a wrinkled branchial membrane, but this is absent on the smaller ones. The pericardial prominence is not conspicuous. The oral tentacles are some distance above the mouth, and the rhinophores point sideways. No eyes are visible. The anal papilla is latero-dorsal, just inside the cerata about halfway down the right side.

The radula consists of 33 horseshoe-shaped teeth, with a large central cusp and six denticles on each side of it. At the base of these main denticles, or between them, are occasional accessory denticles. The jaws are yellowish, with a single row of rather coarse teeth.

I doubtfully identify this form with *F. pinnata*, recorded from the Northern and Central Pacific. In favour of the identification are the facts that the living animal had a projecting tail of some length, though this character is not clear in the preserved specimen, that only the larger cerata have the branchial membrane, and that the teeth have six denticles on each side of the central cusp.

HERVIA LINEATA, sp. n. (Plate XVI. figs. 2 & 3.)

Two specimens from Prison Island, Zanzibar. The following are the notes on the living animal:—"General body-colour a translucent white with a slightly red-brown tinge, which is well marked on the rhinophores, and rather less so on the anterior tentacles and on the sides of the narrow groove-like foot. The body is marked with thin clear lines of opaque white. Cerata in four or five clumps; they are of a chocolate colour, with longitudinal, fine, clear, opaque white lines. Between the rhinophores and tentacles are two brilliant vermilion blotches. The foot is narrow and tapering to a tail."

The preserved specimens are of a uniform dirty yellow, and

the largest measures 8 mm. long by 2 broad. The pericardial prominence is large. The cerata, which are not at all caducous, are set on low inconspicuous ridges in groups as follows:—

	<i>Left.</i>	<i>Right.</i>
First group	8	10
Second „	5	4
Third „	5	5
Fourth „	5	5
Fifth „	3	3

The smaller specimen has only four groups of cerata, as in the Plate XVI. The first group is composed differently from the others, and possibly consists of two fused together. The cerata are longish, but, as preserved, slightly inflated in the middle. The innermost and outermost are smaller and the median ones largest, attaining a length of 2 mm. The tentacles are longer than the rhinophores, which are not perfoliate. The foot is produced anteriorly into tentacular angles.

The jaw bears 20–27 distinct coarse denticles of very irregular shape. There is a single series of 18 teeth, of the form usual in *Facelina*, with a strong central cusp and 10–11 longish, somewhat curved denticles on either side.

I cannot see what is the difference between the genera *Hervia* Bergh (1871) and *Rizzolia* Trinchese (1877), and refer this specimen to the former, since it has priority. But it might equally well be referred to *Rizzolia*.

PHIDIANA TENUIS, sp. n.

Two specimens from Wasin Island, British East Africa, dredged in 10 fathoms. The notes on the living animal are as follows:—“About half an inch long and very narrow, vermiform. Tail long, but bearing cerata to the tip. These are nearly all lost, but were uniformly vermilion in colour. Foot white, body pinkish, tentacles and rhinophores white. Foot very narrow behind, broader in front, where it is bordered by a flap on either side; grooved in front but not produced into tentacular angles. Tentacles very long and spreading outwards. Rhinophores very slightly ringed in the distal halves, which are opaque, the proximal halves being translucent.” Of a second specimen caught in the same place next day, it is noted that when it was first captured “the cerata looked vermilion and light violet-blue, but subsequently became practically colourless with a bluish bloom. The vermilion liver does not nearly fill the cerata; it is thin and has numerous short more or less horizontal branches. In this specimen the tentacles and rhinophores appear of nearly the same length.”

The preserved specimens are of a uniform dirty yellow, and the largest is 9 mm. long and 2 broad. Both of them have lost nearly all their cerata, and the disposition of these organs is no longer plain, but apparently they were set in five groups, without

counting the small ones on the tail. The cerata are long, cylindrical, and transparent, allowing the ramifications of the liver to be distinctly seen. As noticed in the living animal, these latter are long and thin, with well-developed knobs or short branches. The rhinophores and tentacles are also long and thin; the former bear about 15 rings near the top, but are smooth below. The foot is very narrow, with thin projecting margins: in front it is expanded into a semicircular disk; the anterior margin is grooved, and the corners are rounded.

The jaws, which were examined in all three specimens, were transparent and very delicate. No denticles were to be seen on the edge, and, though it is hard to be certain of their absence in dealing with such slight and colourless material, it is to be observed that they were found without difficulty in other similar forms. The radula consists of a single series of horseshoe-shaped teeth numbering 23, 20, and 18 respectively, in the three specimens. Thin, pointed, lateral denticles extend almost up to the tip of the central cusp: there are as many as 20 on either side, but sometimes the number sinks to 15.

I think these specimens should be referred to *Phidiana*, in spite of the doubt about the jaws, and should form a new species, chiefly characterised by the large number of lateral denticulations on the teeth. Also, the branches of the liver, which in other species are covered with knobs, seem to bear distinct short branches.

FACELINA LINEATA, sp. n. (Plate XVI. figs. 4 & 5; and Plate XVII. figs. 10 & 11.)

Two specimens from Zanzibar.

The notes on the living animal say that it had a general resemblance to *Hervia lineata*, which was caught about the same time, but the colours were brighter, and there was an orange-red ring round each of the cerata near the tip. The rhinophores were jet-black. There were white lines on the body but not on the cerata, and there were three red blotches between the tentacles and rhinophores. The tail was long, and there was a very deep groove along the front of the foot.

The largest of the preserved specimens is 6 mm. long and 2.5 mm. broad, but is evidently much contracted. The colour is a uniform alcoholic yellow, except that the rhinophores are still black. The disposition of the cerata is not quite clear, as many have been lost, but appears to correspond with the drawing. The genital orifices seem to be below and between the first and second group, and the vent after the third. The cerata are longish and cylindrical. The oral tentacles are large and thick, but are clearly much contracted, as are also the rhinophores, the perfoliations on which are not so distinct as might be expected from the drawing of the living animal (Pl. XVI. fig. 4). The narrow foot is expanded at the sides into thin margins, and anteriorly into deeply grooved tentacular processes.

The radula consists of a single series of teeth of the form usual in the genus, with a moderately large central cusp and six denticles on each side, of which the innermost and outermost are the smallest and the median the largest. The jaws bear a single series of 35 rather irregular denticles. The verge is armed with spines.

This appears to be a new species of *Facelina*, but I have not had an opportunity of seeing the description of *F. cyanella* (Couth.), which Bergh refers to this genus with a query.

PHYLLODESMIUM HYALINUM Ehrenb.

[Ehrenberg, Symbolæ Physicæ, series prima, 1831; Bergh, "Anatomisk Undersøgelse af *Ph. hyalinum*," Naturhist. Foren. Vidensk. Meddelelser, 1860.]

One specimen dredged in about 10 fathoms near Wasin.

The notes on the living animal are as follows:—"About one inch long. Body semiopaque, pure white. Rhinophores and tentacles ditto. Rhinophores slightly annulated, shorter than the tentacles. Cerata very long and opaque, so that the liver is not visible; whitish violet in colour; their upper halves and the whole length of the sides are covered with low rounded projections, between which dark-brown pigment is found. The first groups of cerata are almost at the side of the rhinophores, and consist of only two cerata on each side. The remaining cerata are set in seven pairs of clumps of four each, and there is a space between the second and third pairs of clumps. The cerata are somewhat flattened."

The preserved specimen is 10.5 mm. long and 3 broad, with a thread-like tail. Relatively to the size of the animal, the cerata are enormous, the largest being 8 mm. long. They are flattened, rather convex on the outer and concave on the inner face. The edge all round is marked by a line of knobs, which are, however, more numerous at the top than at the bottom. On the outer side the whole surface of the upper half is covered with similar knobs. On the inner side the surface is mainly smooth except at the edges, but at the very top there are a few knobs. The cerata are largest on the inside, and gradually decrease outwards. The smallest appear to have no knobs. The larger are easily detached, and hence the arrangement of groups was not easy to see in the preserved specimen, but it appeared to have been as described in the notes on the living animal. The rhinophores are short and thick, set close together, and annulate. The tentacles are longish and curved. The foot is grooved anteriorly, and produced into moderately long but not conspicuous tentacular angles. The anal papilla is latero-dorsal, just behind the rather large pericardial prominence. The genital openings are under the rhinophores.

The jaws bear five or six coarse denticles, of which three are very large indeed, the others smaller. The radula consists of sixteen colourless teeth, bearing between 30 and 40 denticles on each side. The shape is much as in Bergh's plates (*l. c.*), but the denticles are rather longer.

HERMÆIDÆ.

STILIGER VARIANS, sp. n. (Plate XVI. fig. 6.)

Several specimens from Prison Island in Zanzibar Harbour, found in green-branched seaweed, in which they are practically invisible. The colour was very variable, ranging from dark brown to white, but was as a rule brilliant green. After being kept in captivity for a night, the animals grew perceptibly paler. The main colour was largely hidden, except at the sides of the body and in the centre of the back, by numerous lines of a deeper colour, generally dark bright green, and in some, but not all, specimens there were more or less extensive patches of crimson lake. The form was somewhat elongate, and the maximum dimensions 10 mm. by 2 mm. The foot was fairly broad and green.

The preserved specimens are colourless and semitransparent. They have contracted into an oval or nearly semicircular form, and strongly resemble small tufts of seaweed. The centre of the back is bare, and through its transparent integuments can be seen a great number of circular folliculate organs which are apparently the follicles of the hermaphrodite gland. There are about ten transverse rows of cerata in the largest specimens, containing four (or sometimes five) cerata on each side of the central space. The two innermost cerata of each row are large (about 3.50 mm. \times 2 mm.) and somewhat inflated. The others are very much smaller and look like mere tubercles. They all contain ramifications of the liver, consisting of one large main stem from which spring three or four quite small and short branches. The bladder-like pericardial prominence is somewhat elongate; in front of it and fused with it is the anal tube. The rhinophores are entire and not grooved. In the largest specimen they are about 3 mm. long and rather thick, as if contracted. Below them are two lumps which may be regarded either as a frontal veil notched in the middle, or as rudimentary tentacles. The anterior angles of the foot are not much produced. The tail is pointed but not long.

The radula was examined in several specimens, and was found in all to consist of four or five teeth in the ascending part and six in the descending, while the number in the heap did not seem to exceed six or eight.

The teeth (Pl. XVI. fig. 6) are somewhat like those of *Ercolania siottii* (v. Trinchese, 'Aeolididæ del Porto di Genova,' vol. ii. pl. x. figs. 7 & 8), and have a broad spoon-like hollow into which the tooth behind fits.

In my account of Mr. Gardiner's Nudibranchs ('Fauna and Geography of the Maldive and Laccadive Archipelagoes,' vol. ii. pt. i. p. 571, and pl. xxxii. figs. 9 & 10) this animal is erroneously figured as *Hermæa minor*. It is, however, not a *Hermæa* and not identical with Mr. Gardiner's specimen. That specimen is a *Hermæa*, and may possibly be *H. minor*, as there suggested.

STILIGER IRREGULARIS, sp. n. (Plate XVII. fig. 12.)

Two specimens from Chuaka on the East Coast of Zanzibar, found among Sertularians. The animal had a somewhat peculiar appearance owing to the hinder cerata being about twice as long as those in front and spreading out in a fan-like shape. One specimen was of a translucent white, but the liver, extending in two lines down the side of the body and giving off branches to the cerata, was green, and created an impression that the whole animal was of that colour. In the other specimen the branches of the liver in the cerata were of a dirty yellow, and there was some reddish-grey pigment in the integuments of the body, so that the longitudinal liver-tubes were not easily discernible. Near the head, however, they were distinct and green. The cerata in this specimen had white spots. The animals were less than 2 mm. long.

Only one specimen has been preserved, and its very small dimensions rendered examination rather difficult. In the hinder part of the body there are two longitudinal lines of cerata arranged in five transverse rows on each side, of which the inner are two or three times as long as the outer. In the front part there is a single line of five small cerata, and there are no signs of others having been detached. The cerata are cylindrical, much like those of *Hermæa dendritica*, and not inflated or ovate. Though the surface of the liver-branches is irregular, they do not appear to have distinct secondary ramifications within the cerata. No pericardial prominence is visible. The rhinophores are short and simple; behind them are two very distinct black eyes. The oral veil is circular and not notched. The foot is truncate in front; there were no signs of a groove or tentacular prolongations of the corners.

The radula consists of four teeth in the ascending portion, six in the descending, and a small heap. The teeth are much like those of *S. varians*, but the outline is somewhat simpler and less wavy (Pl. XVII. fig. 12).

PHYLLOBRANCHIDÆ.

[Bergh, in S. R. ii. & xvi.; id. Beiträge zur Kennt. d. Aeolidiaden, ix.; A. & H., Coll. of Nudibr. Moll. made in India, p. 145; Trinchese, Aeolididæ del Porto di Genova, 1881; Pelseneer, Recherches sur divers Opisthobranches, 1894, pp. 50-52.]

This remarkable family, which is characterised by its flat leaf-like dorsal papillæ, consists of three genera, *Phyllobranchus*, *Cyerce*, and *Caliphylla*, of which the first two are recorded from the Indo-Pacific (but *Ph. viridis* from the West Indies), and the last from the Mediterranean. They all agree in having flat leaf-like cerata, an ascoglossan radula and a buccal crop, complicated reproductive organs, and (except *Caliphylla*) oral tentacles as well as rhinophores. *Cyerce*, though very like *Phyllobranchus*

superficially, presents many points of difference and is certainly not a mere subgenus, as it is considered by Fischer (Manuel de Conch. p. 343). Externally the chief difference is that the foot in *Phyllobranchus* is, as usual, an undivided surface, whereas in *Cyerce* there are two distinct parts separated by a transverse division. In *Phyllobranchus* the buccal crop is long and twisted, the vent lateral, and the teeth are preserved in a spiral. In *Cyerce* the crop is flat and oval, the vent dorsal, and the teeth are preserved in an irregular heap. The digestive organs also present important differences, the chief of which is that whereas in *Phyllobranchus* (and in *Caliphylla*) the liver is ramified within the dorsal papillæ, in *Cyerce* it appears not to enter them at all and to be wholly contained in the body-cavity.

The function of the large buccal crop is obscure. It would appear that, as a rule, this organ is only found when the radula is uniseriate (ascoglossan) or very narrow (*Lamellidoris*, *Goniodoris*, &c.), and when there are no jaws. On the other hand, its presence under these conditions does not appear to be necessary (*e. g.* *Elysiadæ* and *Hermæidæ*).

PHYLLOBRANCHUS PRASINUS B.

[Bergh, in S. R. Heft ii. pp. 52-87.]

Fourteen specimens from Chuaka on the East Coast of Zanzibar, mostly about 3 centimetres long, but two much larger, measuring over 5 centimetres in life. The animals were found at low tide. The colour is described as transparent, with small green branching lines on the cerata, giving on the whole an effect of greyish green. It was noticed that the cerata break off easily when the animal is disturbed, and retain the power of independent movement for some time.

The preserved specimens have kept their colour fairly well, but many of them show a yellowish rim round the cerata, not mentioned in the description of the living animal or by Bergh. The yellow spot on the cerata mentioned by Semper is not visible.

The largest preserved specimen, which has lost nearly all its papillæ, is 47 mm. long and 14 broad. The head is separated from the body by a sort of ridge, which descends and forms lappets on each side of the mouth. The oral tentacles are undivided, about 7 mm. long, and slightly grooved. The rhinophores are bifid; the main branch measures 12.5 mm. and the side branch 5.5. Both branches are grooved and also the common stem, but less distinctly. The rhinophores seem larger than in Bergh's specimens; in one specimen only 25 mm. long they measure 12 mm. At the base of the rhinophores the black eyes are clearly visible. The pericardial prominence lies 14 mm. from the anterior margin. The opening for the penis is immediately behind the right tentacle. The large female genital papilla is a little further back on the right-hand side, under the rhinophores. Still further back is the large, cup-shaped, anal papilla, under the anterior end of the pericardial prominence. The foot has thin

wide lateral margins and a tail 9 mm. long; the anterior margin is thick, distinctly, but not very deeply, grooved, and produced into tentacular expansions at the corners. The centre of the back is bare, with small irregular tubercles, whose number varies greatly in different individuals. The sides are covered with cerata, which extend right up to the lappets of the mouth. They are easily detached, and all the specimens have lost many, but they appear to be arranged in four longitudinal rows on each side, with a few very small extra ones at the extreme outside. They consist of an oval plate set on a short stalk; at the junction of the plate and the stalk is generally a small funnel-like depression. The edges of the plate are smooth and not denticulate, as in Bergh's specimens. On the inner surface are a number of lines bearing small yellowish tubercles. These lines spring from three main trunks, but subdivide, so that there are 10-15 at the edge. The largest papillæ are those on the inside nearest the centre of the back. In fine specimens the stalk is about 2 mm. high and the plate 7 long and 6 broad.

The anatomy of this remarkable animal has been described by Bergh (*l. c.*) with such elaborate thoroughness that a further account is hardly necessary, although the function of some of the internal organs is not clear. Both the digestive and reproductive systems are extremely complicated. The buccal mass is large (8.5 by 5 mm.) and striped. The radula is of the ascoglossan type, the teeth being preserved in a regular spiral, not a heap. Only two or three teeth are in use at a time, but the total number varies between 40 and 50 in large specimens. The shape of the teeth is as described by Bergh, not elongate, with an indentation in the back, and 12-14 squarish denticles on the edges. The digestive apparatus including the large crop (which measured 35 mm. by 2 mm. when straightened) was as described by Bergh; but although I was able to follow the "Seitengallengange" for a considerable length, I did not succeed in seeing that they form a complete circuit and unite behind. It seemed clear that the hepatic system resembles that of the Aeolids, and is ramified within the cerata.

Though there is no sufficient reason to regard these specimens as specifically distinct from *Ph. prasinus* B., points of difference (such as the shape of the cerata, the length of the rhinophores, and perhaps the coloration) are not wanting, and may indicate a distinct variety.

CYERCE ELEGANS B.

[B. in S. R. Heft ii. pp. 99-113.]

Three specimens from Chuaka. Mr. Crossland says of the living animal:—"The foot and central part of the body are white, the sides of the body being dull green (? liver). Cerata very delicate and colourless. Head, rhinophores, &c. translucent white."

The preserved specimens are colourless, with semitransparent integuments which allow the internal organs to be seen, particu-

larly a large folliculate mass which covers the sides and part of the centre.

The largest specimen is 20·5 mm. long and 11 broad across the back. The general construction of the head-parts is as in *Phyllobranchus*, with the dividing line running down and forming lappets by the mouth, grooved oral tentacles, and grooved bifid rhinophores about 4 mm. long. At the base of these latter can be seen the large black eyes. The genital openings are as in *Phyllobranchus*, but the intestine terminates dorsally in a cylindrical tube set in front of the pericardium and slightly to the right of the median line. The foot is in two divisions, of which the anterior is the wider, being 17·5 mm. broad by 7·5 in the longitudinal direction of the body, whereas the posterior portion is 12 mm. long by 9·5 at its broadest part. Except for this division, the foot is as in *Phyllobranchus prasinus*, but the corners of the anterior margin are not much produced. Nearly all the papillæ have fallen off, but it appears that they were arranged at the sides of the back, leaving the centre bare. The largest are about 5 mm. high and 3·5 broad. Though they taper towards the base, they have not a distinct stalk. On their margins are 8–10 yellowish spots. The anatomy of this species, like that of *Phyll. prasinus*, has been elaborately investigated by Bergh (*l. c.*), but the structure of the hepatic system is obscure. In my specimens most of the papillæ are quite transparent, and it seems clear that they contain no hepatic branches, and when they are held out from the body the folliculate mass, which I take to be the liver and which is distinctly visible, is not seen to send any prolongations into their transparent bases. On the other hand, the folliculate mass adheres to the sides of the body-wall in the neighbourhood of the papillæ, which it does not do elsewhere, and must be in immediate contact with the openings at their bases. Within the papillæ are round bodies which look like minute bubbles, and in some cases it seemed that these bubbles were connected by a system of colourless canals. I have unfortunately no means here (East Africa) of preparing sections for microscopic examination.

The radula consists of elongated teeth as figured by Bergh (*l. c.* pl. xv. figs. 5–11), each bearing 12–17 denticles, but the number of teeth seemed less, and was 14+9 in one specimen and 17+10 in another. The second figure in these expressions represents the teeth which have fallen down into an irregular heap, and this heap was much smaller than that described and figured by Bergh, possibly in consequence of the youth of the specimens.

ELYSIADÆ.

PLACOBANCHUS OCELLATUS Van Hass. = PL. ARGUS B. (Plate XVII. figs. 13 & 13 a.)

[B. in S. R. iii. pp. 147–165, and id. Danish Exp. to Siam, Opisth. pp. 180–181.]

Two specimens from Prison Island, Zanzibar Harbour. The larger measured 30 mm. in length, and 15 in breadth when the